BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA
DOCKET NO. 2020-3-E

In the Matter of:	)	**DIRECT TESTIMONY OF**
Annual Review of Base Rates	)	**STEVEN D. CAPPS FOR**
for Fuel Costs for	)	**DUKE ENERGY CAROLINAS, LLC**
Duke Energy Carolinas, LLC, Decreasing	)	
Residential and Non-Residential Rates	)	

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Steven D. Capps and my business address is 526 South Church Street, Charlotte, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Senior Vice President of Nuclear Operations for Duke Energy Corporation ("Duke Energy") with direct executive accountability for Duke Energy's South Carolina nuclear plants, including Duke Energy Carolinas, LLC's ("DEC" or the "Company") Catawba Nuclear Station ("Catawba") in York County, South Carolina, the Oconee Nuclear Station ("Oconee") in Oconee County, South Carolina, and Duke Energy Progress, LLC's ("DEP") Robinson Nuclear Plant, located in Darlington County, South Carolina.

Q. WHAT ARE YOUR RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR OPERATIONS?

A. As Senior Vice President of Nuclear Operations, I am responsible for providing executive oversight for the safe and reliable operation of Duke Energy's three South Carolina operating nuclear stations. I am also involved in the operations of Duke Energy's other nuclear stations, including DEC's McGuire Nuclear Station ("McGuire") located in Mecklenburg County, North Carolina

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have more than 33 years of experience in the nuclear field. I joined Duke Energy in 1987 as a field engineer at Oconee. During my time at Oconee, I served in a variety of leadership positions at the station, including Senior Reactor Operator, Shift Technical Advisor, and Mechanical and Civil Engineering Manager. In 2008, I transitioned to McGuire as the

Engineering Manager. I later became plant manager and was named Vice President of McGuire in 2012. In December 2017, I was named Senior Vice President of Nuclear Corporate for Duke with direct executive accountability for Duke Energy's nuclear corporate functions, including nuclear corporate engineering, nuclear major projects, corporate governance and operation support and organizational effectiveness. I assumed my current role in October 2018. I earned a B.S. in Mechanical Engineering from Clemson University.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to describe and discuss the performance of DEC's nuclear fleet during the period of June 1, 2019 through May 31, 2020 (the "review period").

Q. YOUR TESTIMONY INCLUDES THREE EXHIBITS. WERE THESE EXHIBITS PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR SUPERVISION?

A. Yes. These exhibits were prepared at my direction and under my supervision.

Q. PLEASE PROVIDE A DESCRIPTION OF THE EXHIBITS.

A. The exhibits and descriptions are as follows:

Capps Exhibit 1 - Calculation of the nuclear capacity factor for the review period pursuant to S.C. Code § 58-27-865

Capps Exhibit 2 - Nuclear outage data for the review period

Capps Exhibit 3 - Nuclear outage data through the billing period [1]

[1] This data is provided in confidential and publicly redacted versions for security purposes.

Q. PLEASE DESCRIBE DEC'S NUCLEAR GENERATION PORTFOLIO.

A. The Company's nuclear generation portfolio consists of approximately 5,389[2] megawatts ("MWs") of generating capacity, made up as follows:

Oconee -	2,554 MWs
McGuire -	2,316 MWs
Catawba -	519 MWs[3]

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF DEC'S NUCLEAR GENERATION ASSETS.

A. DEC's nuclear fleet consists of three generating stations and a total of seven units. Oconee began commercial operation in 1973 and was the first nuclear station designed, built, and operated by DEC. It has the distinction of being the second nuclear station in the country to have its license, originally issued for 40 years, renewed for up to an additional 20 years by the NRC. The license renewal, which was obtained in 2000, extends operations to 2033, 2033, and 2034 for Oconee Units 1, 2, and 3 respectively.

McGuire began commercial operation in 1981 and Catawba began commercial operation in 1985. In 2003, the NRC renewed the licenses for McGuire and Catawba for up to an additional 20 years each. This renewal extends operations until 2041 for McGuire Unit 1, and 2043 for McGuire Unit 2 and Catawba Units 1 and 2. The Company jointly owns Catawba with North Carolina Municipal Power Agency Number One, North Carolina Electric Membership Corporation, and Piedmont Municipal Power Agency.

[2] Based on Net Maximum Dependable Capacity as of January 1, 2020.
[3] Reflects DEC's 19.2 percent ownership of the Catawba Nuclear Station.

Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?

A. The primary objective of DEC's nuclear generation department is to safely provide reliable and cost-effective electricity to DEC's Carolinas customers. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high-quality work activities, which effectively ready the plant for operation until the next planned outage.

Q. PLEASE DISCUSS THE PERFORMANCE OF DEC'S NUCLEAR FLEET DURING THE REVIEW PERIOD.

A. The Company operated its nuclear stations in a reasonable and prudent manner during the review period, providing 62 percent of the total energy generated by DEC. The seven nuclear units operated at an actual system average capacity factor of 95.1 percent for the review period which included five refueling outages.

As shown on Capps Exhibit 1, DEC achieved a net nuclear capacity factor, excluding reasonable outage time, of 101.24 percent for the review period. This capacity factor is above the 92.5 percent set forth in S.C. Code § 58-27-865(F), which states in pertinent part:

> There shall be a rebuttable presumption that an electrical utility made every reasonable effort to minimize cost associated with the operation of its

> nuclear generation facility or system, as applicable, if the utility achieved a net capacity factor of ninety-two and one-half percent or higher during the period under review. The calculation of the net capacity factor shall exclude reasonable outage time associated with reasonable refueling, reasonable maintenance, reasonable repair, and reasonable equipment replacement outages; the reasonable reduced power generation experienced by nuclear units as they approach a refueling outage; the reasonable reduced power generation experienced by nuclear units associated with bringing a unit back to full power after an outage....

The performance results discussed above support DEC's continued commitment for achieving high performance without compromising safety and reliability.

Q. HOW DOES DEC'S NUCLEAR FLEET COMPARE TO INDUSTRY AVERAGES?

A. Industry benchmarking efforts are a principal technique used by the Company to ensure best practices. Duke Energy's nuclear fleet continues to rank among the top performers when compared to other large domestic nuclear fleets using Key Performance Indicators ("KPIs") in the areas of personal safety, radiological dose, manual and automatic shutdowns, capacity factor, forced loss rate, industry performance index, and total operating cost. On a larger industry basis using 2019 data from the Electric Utility Cost Group, all three of DEC's nuclear plants rank in the top quartile in total operating cost per MWH among the 57 U.S. operating nuclear plants. By continually assessing the Company's performance as compared with industry benchmarks, the Company continues to ensure the overall safety, reliability and cost-effectiveness of DEC's nuclear units.

Additionally, for 20 consecutive years DEC's nuclear plants have surpassed a 90 percent annual capacity factor threshold. As a result of this strong operational performance, the Company has produced approximately 43.9 million MWHs of additional generation, which is equivalent to an additional 9.1 months of output (based on DEC's average annual generation for the same 20-year period). These performance results support

DEC's continued commitment to achieving high performance without compromising safety and reliability.

Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEC'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?

A. In general, refueling requirements, maintenance requirements, prudent maintenance practices, and NRC operating requirements impact the availability of DEC's nuclear system. Prior to a planned outage, DEC develops a detailed schedule for the outage and for major tasks to be performed including sub-schedules for particular activities.

The Company's scheduling philosophy is to plan for a best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time an outage task was performed is 10 days, then 10 days or less becomes the goal for that task in each subsequent outage. Those individual goals are incorporated into an overall outage schedule. The Company aggressively works to meet, and measures itself against, that schedule. Further, to minimize potential impacts to outage schedules, "discovery activities" (walk-downs, inspections, etc.) are scheduled at the earliest opportunity so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan.

As noted, the schedule is utilized for measuring outage planning and execution and driving continuous improvement. However, in order to provide reasonable, rather than best ever, total outage time for planning purposes, particularly with the dispatch and system operating center functions, DEC also develops an allocation of outage time which incorporates unforeseen schedule delays that may be needed for unplanned equipment

repairs found during inspections. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

Q. HOW DOES DEC HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?

A. When an outage extension becomes necessary, DEC expects that work completed in the extension results in longer continuous run times and fewer forced outages, thereby reducing overall fuel costs in the long run. Therefore, if an unanticipated issue that has the potential to become an on-line reliability issue is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage may be extended for the minimum time needed to perform necessary maintenance or repairs prior to returning the unit to service. In the event that a unit is forced off-line, every effort is made to perform the repair and return the unit to service as quickly as possible. DEC assesses potential causes of each forced outage or extended outage and implements best practices moving forward. The nuclear industry recognizes that constant focus on operational excellence results in improved nuclear safety and reliability.

Q. WHAT OUTAGES WERE REQUIRED FOR REFUELING AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. There were five refueling outages during the review period; fall 2019 outages at Catawba Unit 2 and Oconee Unit 2, followed by spring 2020 outages at McGuire Unit 2, Oconee Unit 3, and Catawba Unit 1.[4] All five refueling outages were successfully completed within the scheduled allocation.

[4] The Catawba Unit 1 refueling outage ended on June 1, 2020 at 8:34 AM, 8 hours and 34 minutes beyond the current review period.

Following a breaker-to-breaker continuous run of 518 days, Catawba Unit 2 was removed from service on September 14, 2019 for refueling. In addition to refueling, major pump and motor work included replacement of the 2B and 2C reactor coolant pump seals, and replacement of the 2A reactor coolant charging pump motor. The 2C1 heater drain pump and motor, the 2A hotwell pump motor, and the 2A2 component cooling water pump motor were all refurbished. In addition, the 2C condensate booster pump motor was rewound. Major mechanical preventive maintenance and replacement of the 7R cylinder liner was completed on the 2A diesel generator. The 2B reactor coolant system hot leg resistance temperature detector was replaced. Major test and inspection activities included steam generator Eddy Current testing, reactor vessel hot leg ultrasonic testing, 2A feedwater pump turbine inspection, and cleaning and inspection of the main condenser tubes. Main power relay testing for zone "2B" and "2G" was also completed. After refueling, maintenance, and modifications were completed, the unit returned to service on October 9, 2019. The duration of the refueling outage was 24.9 days as compared to a 29-day allocation.

The Oconee Unit 2 refueling outage began on November 8, 2019 following a 712-day breaker-to-breaker continuous cycle run. In addition to refueling activities, significant scope included replacement of the unit's three low pressure turbine rotors, and the successful completion and testing of a complex modification to the standby shutdown facility letdown line. Electrical work completed included replacement of power circuit breakers PCB-23 and PCB-24, and completion of major preventive maintenance on the main transformer. Several maintenance activities were performed on the reactor coolant pumps, including two pump seal replacements, four oil cooler change-outs and two upper

motor bearing inspections. Other pump and motor work included replacement of 2A electro-hydraulic control pump, 2D1 heater drain pump and motor, and 2B1 high pressure injection motor. After refueling, maintenance, and modifications were completed, the unit returned to service on December 12, 2019. The duration of the refueling outage was 33.3 days compared to an allocation of 34.5 days.

After completing a continuous cycle run of 524.5 days, McGuire Unit 2 entered a spring refueling outage on March 21, 2020. In addition to refueling, safety and reliability enhancing maintenance, inspections and testing were completed. Maintenance work included the replacement of the 2D reactor coolant pump seal, and preventive maintenance on the 2A nuclear service work pump, 2A chemical and volume control motor, and 2A containment spray motor. Both the 2A and 2B component cooling heat exchangers were cleaned. Inspections on the reactor vessel head, 2B low pressure turbine, and thrust bearings were completed. After refueling, maintenance, inspections, and testing were completed, the unit returned to service on April 13, 2020. The duration of the refueling outage was 23.4 days compared to a 25-day schedule allocation. The outage was accomplished with the lowest dose in the station's history.

Oconee Unit 3 shut down for refueling on April 10, 2020. During the outage, the unit's low pressure turbines were replaced. Safety enhancements included the replacement of the standby shutdown letdown line. Reliability enhancements included the replacements of the 3A high pressure injection motor, 3B reactor building cooling unit motor, 3D1 heater drain pump and motor, 3B1 reactor coolant pump seal, and 20 air operated valve positioners. Preventive maintenance was completed on the 3A and 3B feedwater pumps, main transformer, 3TB switchgear and breaker, and the 3X8 load center. Inspections and

testing included radiography tests on the high pressure injection nozzle thermal sleeve and valves, condenser waterbox and discharge piping inspections, and 3TC switchgear inspections. After refueling, maintenance, testing and inspections completed, the unit returned to service on May 9, 2020. The outage duration was 28.97 days compared to a schedule allocation of 34.5 days.

The fifth refueling outage during the review period began on May 2, 2020 when Catawba Unit 1 shut down for refueling. In addition to refueling activities, safety and reliability enhancements, testing and inspections were completed. Replacement of the unit's low pressure turbines were completed. Other maintenance activities included replacement of the 1C reactor coolant pump motor, replacement of the 1A, 1C, and 1D reactor coolant pump seal packages, and replacement of the 1B reactor coolant charging pump motor. The 1B component cooling water heat exchanger tubes were replaced with new stainless-steel tubes. Volumetric inspection of the reactor vessel head and all head welds, and inspections and testing of seven motor-control centers were completed. After refueling, maintenance, inspections, and testing completed, the unit returned to service on June 1, 2020. The outage duration was 30.2[5] days compared to a 31-day schedule allocation. This outage duration includes overspeed testing of the unit.

Q. HAS OVERSPEED TESTING PREVIOUSLY BEEN INCLUDED IN THE COMPANY'S REPORTED OUTAGE DURATIONS?

A. No. Prior to 2020, the Company did not include overspeed testing, when that testing occurs at the end of an outage, in its reported outage durations. Overspeed testing is usually only

[5] The outage ended on June 1, 2020 at 8:34 AM. Eight hours and 34 minutes of the outage occurred beyond the end of the current review period.

necessary when significant turbine work is completed, such as during the Catawba 1 and Oconee 3 spring 2020 refueling outages when low pressure turbines were replaced. In such cases, the turbine generator is connected to the grid for a brief duration, normally around 5 to 6 hours, as refueling outage activities are concluding. Once the turbine generator reaches normal operating temperatures and operational parameters, the generator is then disconnected from the grid to conduct a turbine overspeed test, which normally has a duration of 1.5 to 4 hours. In previous years, including the Catawba 2 and Oconee 2 fall 2019 refueling outages in this review period, the Company reported the overspeed testing as a separate planned outage event. Under either reporting criterion, all refueling outages in the current review period were completed within the schedule allocation. The Company considers the overspeed test to be a necessary component of the original outage event, and this combined reporting is consistent with Institute of Nuclear Power Operations ("INPO") reporting criteria. The reporting change eliminates the need to maintain two separate generation event logs and facilitates automated reporting. For these reasons, the Company is now reporting all nuclear unit outages that include a trailing turbine overspeed test as a single outage.

Q. OTHER THAN REFUELING, WHAT OUTAGES OCCURRED AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. On February 12, 2020 Catawba Unit 1 was forced offline. A shorting of the Unit 1 exciter brushes occurred, causing a main generator breaker lockout and subsequent turbine trip and reactor trip. The reactor trip was uncomplicated and plant systems responded as expected. Testing and troubleshooting determined that the damage was limited to the exciter brushes, rigging and collector rings. The exciter brushes and damaged brush rigging

was replaced, and the collector rings were ground and polished. After the main generator repairs were completed, the unit returned to service on February 16, 2020. The outage duration was 3 days 10 hours.

Q. DO YOU BELIEVE THE CATAWBA UNIT 1 FORCED OUTAGE WAS CAUSED BY A FAILURE BY THE COMPANY TO MAKE REASONABLE EFFORTS TO MINIMIZE FUEL COSTS?

A. No, the brief forced outage was not caused by a failure by the Company to make reasonable efforts to minimize fuel costs. Based on my oversight and review of operations during the review period, the units were operated reasonably and prudently, and our operations were conducted in a way that minimized our fuel costs. The successful completion of five refueling outages and the achievement of a 95.1 percent capacity factor during the review period, validates the Company's performance.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR CAPACITY FACTOR PURSUANT TO S.C. CODE ANN. § 58-27-865(F)
REVIEW PERIOD OF JUNE 2019 THROUGH MAY 2020

1	Nuclear System Actual Net Generation During Review Period	59,979,779	MWH
2	Total Number of Hours during Review Period	8,784	
3	Nuclear System MDC during Review Period	7,180	MW
4	Reasonable Nuclear System Reductions	3,826,633	MWH
5	Nuclear System Capacity Factor L1/((L2*L3)-L4)*100	101.24	%

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE DATA FOR REVIEW PERIOD OF
June 2019 THROUGH MAY 2020

Nuclear outages during the Review Period

Station/Unit	Date of Outage	Reason for Outage
Catawba 2	9/14/2019 - 10/9/2019	End-of-cycle 23 refueling outage
Oconee 2	11/8/2019 - 12/12/2019	End-of-cycle 29 refueling outage
Catawba 1	2/12/2020 - 2/16/2020	Forced outage - loss of generator field
McGuire 2	3/21/2020 - 4/13/2020	End-of-cycle 26 refueling outage
Oconee 3	4/10/2020 - 5/9/2020	End-of-cycle 30 refueling outage
Catawba 1 [1]	5/2/2020 - 6/1/2020	End-of-cycle 25 refueling outage

[1] The Catawba 1 refueling outage ended on June 1, 2020 at 8:34 AM, 8 hours and 34 minutes beyond the review period.

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE SCHEDULE THROUGH BILLING PERIOD

Scheduled nuclear outages lasting one week or more through the Billing Period

Station/Unit	Date of Outage[1]	Reason for Outage
McGuire 1	[redacted]	Scheduled refueling
Oconee 1	[redacted]	Scheduled refueling
Catawba 2	[redacted]	Scheduled refueling
McGuire 2	[redacted]	Scheduled refueling

[1] This exhibit represents DEC's current plan, which is subject to change based on fluctuations in operational and maintenance requirements.